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Crabs as snake predators? An observation from southern Italy leading to a comprehensive review

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Abstract

The recent elevation of the Western Grass Snake, *Natrix helvetica*, from subspecies status prompted an assessment of its natural history and ecological traits compared to closely related species. We report an unusual predation attempt by the freshwater crab *Potamon fluviatile* on *N. helvetica sicula* from Sicily, indicating an ecological interaction previously overlooked in this species. The observation suggests that this crab may utilise snakes' muscle tissue as an additional nutrient source. This predator-prey interaction, although probably rare, adds to the understanding of the dynamics between crabs and snakes, shedding light on their interaction in freshwater habitats. To provide context for our observation and highlight its rarity, we searched through scientific literature and online sources to generate a comprehensive review of the phenomenon that examines the predatory behaviour of crabs on snakes.

Key Words

Decapoda, ecological interaction, grass snake, *Natrix helvetica*, natural history, *Potamon fluviatile*, predator-prey dynamics

The Western Grass Snake, *Natrix helvetica* (Lacépède, 1789), was recently elevated taxonomically from a subspecies of the *N. natrix* (Linnaeus, 1758) complex, based on a comprehensive genetic assessment (Kindler et al. 2017). Further molecular taxonomic evaluation examined the phylogeographic structure among populations of *N. helvetica* and its subspecific taxonomy (Kindler and Fritz 2018). According to these data, the species (comprising five subspecies) is distributed from Great Britain through central western Europe to Corsica, Sardinia, most of the Italian mainland, and Sicily. Furthermore, its elevation to species level provides renewed opportunities to compare natural history and ecological traits with the two other grass snake species, *N. natrix* and *N. astreptophora* (López-Seoane, 1884). Previous summaries treated the three grass snake species as one, even tough much information on predation referred to populations from western Europe, i.e., *N. helvetica* (Kabisch 1999; Mebert and Jablonski 2024).

Here we report an unusual predation attempt of a freshwater crab, *Potamon fluviatile* (Herbst, 1785), on a Sicilian Grass Snake, *N. helvetica sicula* (Cuvier, 1829), in the "Valle dell'Anapo" (37.142°N, 15.046°E), southeastern Sicily, Italy, observed on 21 March 2024. We encountered the adult freshwater crab while its claws tightly squeezed the tail of the adult snake (close to one meter in length), which was visibly alive (Fig. 1A). This predation attempt was observed for approximately 10 minutes, during which the grip of the crab's claws was strong enough to prevent the snake from freeing itself. Further search that day revealed three more grass snakes missing large portions of their tails (Fig. 1B–D).

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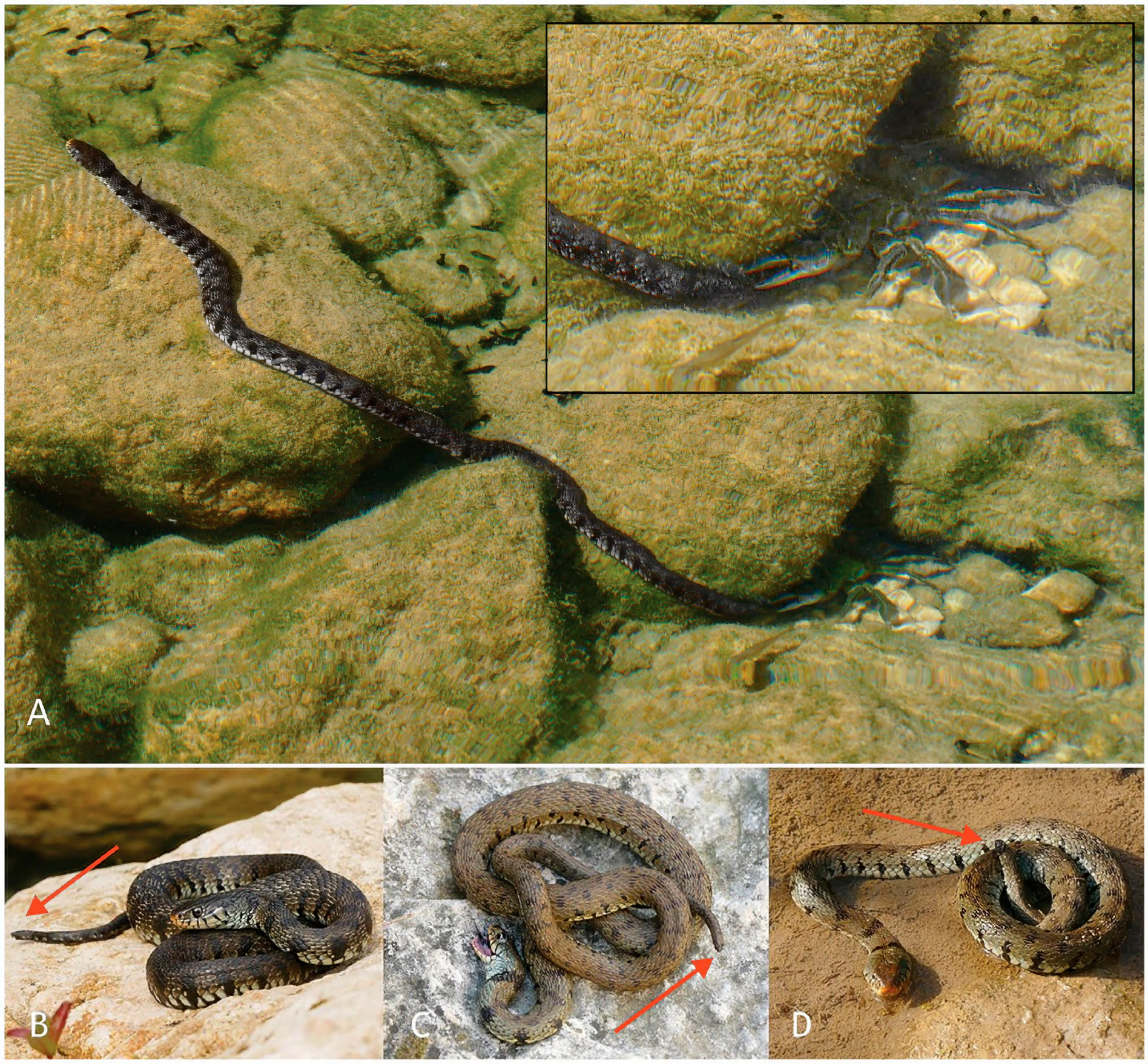

Figure 1. Predation attempt on *Natrix helvetica* by *Potamon fluviatile* from Sicily, Italy: A. adult *N. helvetica* with its tail held by the claw (inset) of a freshwater crab, *P. fluviatile*. B–D. different individuals of *N. helvetica* without the tip of the tail (marked by red arrows), suggesting previous crab-snake interactions. Photographs by David Hegner.

Based on additional 33 *N. helvetica* examined in Sicilian streams, in which *P. fluviatile* and *N. helvetica* coexist, 24.4% (n = 8) showed injured tails (F. P. Faraone, unpubl. data). Presumably, this freshwater crab, which has recently colonised Sicily and has expanded across the island (Vecchioni et al. 2017, 2022), may utilise snake (tail) muscle tissue as an opportunistic nutrition, offering an intriguing perspective on the flexible feeding networks of these freshwater animals. Eventually, tail loss in grass snakes may also result from predation by birds or mammals during the active season, from consumption by rodents, from freezing or dying off during hibernation, or even from pseudoautotomy as a defense against snake predation (Kabisch 1999; Gregory and Isaac 2005; Crnobrnja-Isailović et al. 2016 and references therein).

To compare our data in a global context, we conducted a thorough search of available scientific literature since Voris and Jeffries (1995) published their first topic-related review. We also searched online sources and the most common social network media—Facebook.com, Flickr.com, Instagram.com, Youtube.com—and the citizen-science platform inaturalist.org to compile a summary of this phenomenon that remained rarely observed.

We obtained 21 observations overall in which crabs engaged in a feeding interaction with snakes as prey. These observations encompassed 12 genera of crabs in eight families and 17 genera of snakes (with two cases lacking detailed identification) in eight families (Table 1). Although interactions between snakes and crabs are very rarely observed and reported (see references in Table 1), this is not the first observation of *Potamon* predating on

Table 1. A summary of crabs predating on snakes based on published literature and citizen-science data. cw = carapace width; SVL = snout-vent length.

Predator		Prey			Observed or inferred feeding behaviour	Study area			Date	Source
Species (cw in mm)	Family	Species (SVL in mm)	Family	Condition		Locality/country	Coordinates (Lat, Long)	Habitat		
Scylla serrata	Portunidae	Not determined	–	–	Unknown, snake remains in 5% of crab stomach (n = 86)	Phuket Island/ Thailand	–	Sea	–	Voris and Jeffries (1995)
Scylla serrata	Portunidae	*Cerberus rynchops*	Homalopsidae	Alive	Predation of 24% of 106 experimental trials	Phuket Island/ Thailand	–	Experimental enclosures	–	Voris and Jeffries (1995)
Eudaniela garmani (95)	Pseudothelphusidae	*Pseudoboa neuwiedii* (540)	Dipsadidae	Dead	Unknown, consumed tail first	Little Englishman's Bay/Tobago	–	2 m above the riverbank	27 August 1997	Maitland (2003)
Eudaniela garmani (42)	Pseudothelphusidae	*Atractus trilineatus*	Dipsadidae	Alive	Active predation, consumed tail first	Englishman's Bay/ Tobago	–	Above the water surface of the crab's burrow	23 August 1998	Maitland (2003)
Eudaniela garmani (92)	Pseudothelphusidae	*Erythrolamprus melanotus* (380)	Dipsadidae	Alive	Active predation, the prey's back was damaged	Gilpin Trace/ Tobago	–	1 m above the water level, river	5 June 2000	Maitland (2003)
Eudaniela garmani (~85)	Pseudothelphusidae	*Chironius carinatus*	Colubridae	Dead	Unknown, prey partially consumed	Little Englishman's Bay/Tobago	–	River	3 September 1997	Maitland (2003)
Eudaniela garmani (96)	Pseudothelphusidae	*Oxybelis aeneus* (620)	Colubridae	Dead	Active predation, the prey's back was damaged	Little Englishman's Bay/Tobago	–	Riverbank	6 June 2000	Maitland (2003)
Eudaniela garmani (70)	Pseudothelphusidae	*Sibon nebulatus* (203)	Dipsadidae	Alive	Active predation, consumed tail first	Arnos Vale/Tobago	–	Shallow water, river	22 August 1997	Maitland (2003)
Callinectes sapidus	Portunidae	*Nerodia clarkii* (404)	Natricidae	Alive	Attempted predation	West Ship Island/ USA	30.2091, -88.9783	Sea, shallow water	30 March 2006	Mohrman et al. (2008)
Potamon pelops	Potamidae	*Natrix natrix*	Natricidae	Alive	Active predation, consumed tail first	Charavgi/Greece	36.9847, 21.8550	Shallow water, stream	10 July 2020	Groen et al. (2023)
Exanthelphusa sp.	Gecarcinucidae	*Fowlea* cf. *flavipunctatus*	Natricidae	Dead	Unknown circumstances	Unknown, probably Asia	–	Muddy water (rice field?)	–	https://www.youtube.com/shorts/6VCVk1pI1g0
Parathelphusa convexa	Gecarcinucidae	Blindsnake	Gerrhopilidae or Typhlopidae?	–	Unknown circumstances	Java	–	Probably stream bank	–	https://create.vista.com/it/unlimited/stock-photos/583199136/stock-photo-field-crab-shows-expression-ready-attack-animal-has-scientific-name/
Parathelphusa convexa	Gecarcinucidae	*Xenodermus javanicus*	Xenodermidae	–	Unknown circumstances	Java	–	Probably stream bank	–	https://create.vista.com/it/unlimited/stock-photos/599183670/stock-photo-field-crab-eating-dragon-snake-animal-has-scientific-name-parathelphusa/
Ocypode sp.	Ocypodidae	*Hydrophis platurus*	Elapidae	Dead	Unknown, possible scavenging	Chandrabhaga beach/India	–	Sandy beach	9 February 2023	https://www.newsflare.com/video/543058/
Thalamita cf. *crenata*	Portunidae	*Hydrelaps darwiniensis*	Elapidae	–	Unknown circumstances	Broome/Australia	–	Sea shore	8 March 2017	https://www.flickr.com/photos/reptileshots/33332780516/in/photostream/
Candidiopotamon okinawense	Potamidae	*Hebius pryeri*	Natricidae	Dead	Unknown circumstances	Yanbaru forest, Okinawa/Japan	–	Forest	23 June 2016	https://www.flickr.com/photos/okinawaphotos/27655519790/in/photostream/
Potamonautes sp.	Potamonautidae	*Causus* cf. *rhombeatus*	Viperidae	Dead	Unknown circumstances	Unknown, probably Africa	–	Probably, backyard pavement	–	https://www.reddit.com/r/natureismetal/comments/17j0y18/crab_eating_a_snake/
Potamon fluviatile	Potamidae	*Natrix* cf. *helvetica*	Natricidae	Dead	Unknown circumstances	Italy (?)	–	Shallow water, stream	–	https://www.youtube.com/watch?v=jhiiofyj1lg
Potamon fluviatile	Potamidae	*Natrix helvetica*	Natricidae	Alive	Active predation	Valle dell'Anapo/ Italy	37.142, 15.046	Shallow water, stream	21 March 2024	This study
Birgus latro	Coenobitidae	*Boiga irregularis*	Colubridae	Alive	Attempted predation	Northern Guam	13.603, 144.871	Tree 0.7 m above ground	8 March 2010	Lardner et al. (2011)
Dilocarcinus pagei	Trichodactylidae	*Helicops leopardinus*	Colubridae	Dead	Scavenging	Macapá, Amapá state, Brazil	0.045, -51.067	Municipal pond	13 April 2018	Tavares-Pinheiro et al. (2018)
?	?	?	?	Dead	Feeding or scavenging	Indonesia	–	Shallow water, stream	–	https://www.facebook.com/reel/975446370681443

Natrix. Groen et al. (2023) described a similar predation attempt on a juvenile *N. natrix* by a Peloponnesian Freshwater Crab, *Potamon pelops* Jesse, Schubart, Klaus, 2010, in Greece. The authors did record the consumption of the snake's tail, the cloaca, and part of the lower abdomen (likely the most easily captured part of a snake's body by a crab) but did not complete their observation to record whether the crab fully consumed the snake. One of the cases reported in Table 1 is a video probably taken in Italy (https://www.youtube.com/watch?v=jhiiofyj1lg), which shows a *P. fluviatile* eating a dead adult *N. helvetica*, similarly to what we describe herein. However, no information was obtained to confirm the circumstances of this record, e.g., whether it shows a predation or scavenging event.

Further observations were gathered from all continents where snakes and crabs coexist and included interactions from various habitats and situations (i.e., active or attempted predation): for example, a video and text by Shakit Nanda (2023; https://www.newsflare.com/video/543058/) shows a Ghost Crab, *Ocypode* sp., pulling a deceased Yellow-bellied Sea Snake, *Hydrophis platurus* Linnaeus, 1766, into its sandy burrow on Chandrabhaga Beach, Eastern India. A photograph showing another beach crab holding on to a Black-ringed Mangrove Sea Snake, *Hydrelaps darwiniensis* Boulenger, 1896, in Broome, Western Australia (Brendan Schembri 2017 on flickr.com). In Sri Lanka, a Common Freshwater Crab, *Ceylonthelphusa sentosa* Bahir, 1999, grabbed the tail of a Schokar's Bronzeback Snake, *Dendrelaphis schokari* (Kuhl, 1820), but it became distracted by the observers a few minutes later and subsequently released/lost the snake (De Zoysa et al. 2015). Lardner et al. (2011) reported that a Coconut Crab, *Birgus latro* (Linnaeus, 1767) in northern Guam held onto, and later released, the tail of a large Cat-eyed Snake, *Boiga irregularis* (Bechstein, 1802) (SVL 1124 mm, total length 1423 mm). Additionally, the same authors mention that 40% of *B. irregularis* on the Orote Peninsula in Guam showed tail damage, indicating that crabs often attempt to prey on snakes in that area. The authors thus suggest a possible correlation between crab densities and the incidence of tail damage (Lardner et al. 2011). The aforementioned records thus support our assumption from Sicily that (mostly) snake tails are used as a food source by decapods, particularly crabs, likely due to the fact that this body part is small enough to be easily caught by their claws, aside from juveniles that also exhibit a small body circumference. We can alternatively hypothesise that predation pressure (where crabs represent a good example) on the tail may have contributed to the development of the little-studied pseudoautotomy (see review in Crnobrnja-Isailović et al. 2016), which has also been observed in semiaquatic snakes, including the genus *Natrix*.

Furthermore, Tavares-Pinheiro et al. (2018) observed an adult female freshwater crab, *Dilocarcinus pagei* Stimpson, 1861, feeding on a partly decomposed juvenile water snake, *Helicops leopardinus* (Schlegel, 1837), in a temporary pond in Macapá, Amapá State, Brazil. A predation attempt by a Blue Crab, *Callinectes sapidus* Rathbun, 1896 in Mississippi, USA, was described by Mohrman et al. (2008). Maitland (2003) documented six incidences of the freshwater crab *Rodriguezus* (formerly *Eudaniela*) *garmani* (Rathbun, 1898) from Tobago Island preying on three species of snakes: *Sibon nebulatus* (Linnaeus, 1758), *Atractus trilineatus* Wagler, 1828, and *Oxybelis rutherfordi* Jadin et al., 2020 (see details in Table 1).

Nonetheless, our rare observation contributes to the ongoing discussion on tail injuries in snakes resulting from predation pressure, confirming the occurrence of such ecological interactions between crabs and Grass Snakes. Furthermore, it represents the first well-documented instance of this interaction for both the Western Grass Snake *N. helvetica* and the geographic region.

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